TECHNOLOGY OF CEREALS

AN INTRODUCTION FOR STUDENTS OF FOOD SCIENCE AND AGRICULTURE

FOURTH EDITION

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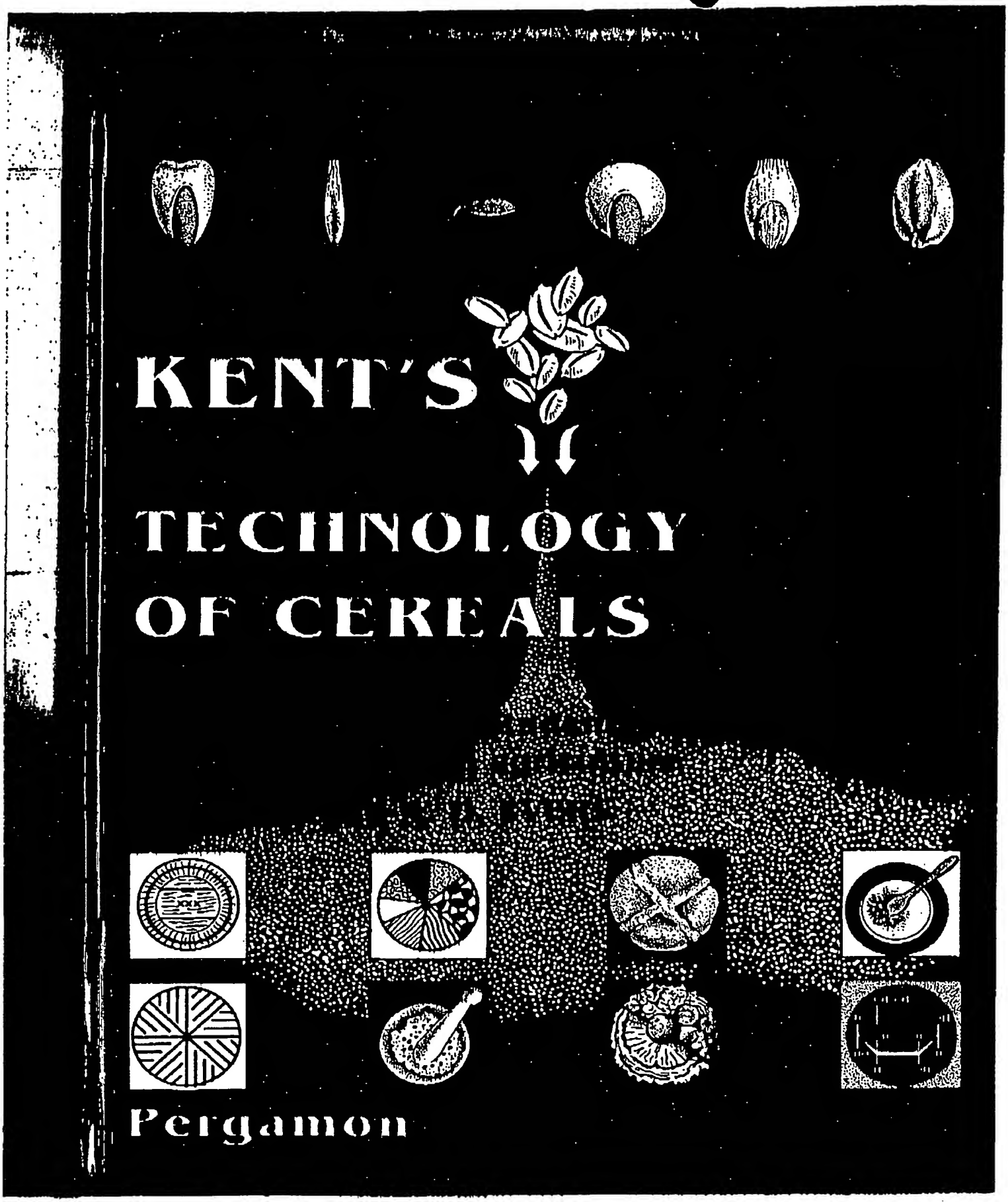

weeks) and developers (13–18 weeks), 48% for laying hens (Nakaue and Arscott, 1991).

For horses, 25–39% of the feed could be cracked maize, along with 45–30% of rolled and 7–10% of wheat bran (Ott, 1991).

By-products of the milling of maize are also used for animal feeding. A product known as hominy feed comprises the entire by-product streams from the dry milling of maize. It is a relatively inexpensive high-fibre, high-calorie material which is high in carotenoids (yellow pigments desirable for chicken feed) and vitamins A and D. Hominy feed is an excellent source of energy for both ruminants and monogastric animals, in this respect being equal or superior to whole maize. Hominy feed competes with other maize by-products — corn gluten feed and spent brewers' grains — as an animal feed. Hominy feed may partially replace grain in diets for horses, provided the feed is pelleted (Ott, 1991). Gluten feed is recovered from the steeping water in which maize is steeped as a stage in wet-milling (q.v.). After the separation of the germ, in the wet-milling of maize, and extraction of the oil, the residue — germ cake — is used for cattle feed.

Maize cobs

The maize cob (corn cob in the U.S.A.) is the central rachis of the female inflorescence of the plant to which the grains are attached, and which remains as agricultural waste after threshing. As about 180 kg of cobs (d.b.) are obtained from each tonne of maize shelled, the annual production of cobs in the U.S.A. alone is of the order of 30 million tonnes.

Cobs consist principally of cellulose 35%, pentosans 40% and lignin 15%. Agricultural uses for maize cobs, listed by Clark and Lathrop (1953), include litter for poultry and other animals; mulch and soil conditioner; animal and poultry feeds. The feeding value of corncobs is about 62% of that of grains. Up to 67% of ground corncobs, with 14% of ground shelled maize and some soyabean meal and molasses-urea provided a suitable feed for cattle. For poultry, a feed containing corncob meal plus ground maize is preferred to one in which ground maize is the sole cereal because it results in better plumage, less feather-picking, and less cannibalism. On the other hand, the corncob plus maize feed gives a reduced egg production and less body-weight gain (Clark and Lathrop, 1953).

Barley for animal feed

Apart from its use in malting, brewing and distilling (c.f. Ch. 9), the next most important use for barley is as food for animals, particularly pigs, in the form of barley meal.

As whole barley contains about 34% of crude fibre, and is relatively indigestible, the preferred type of barley for animal feeding is one with a low husk content. Low protein barleys are favoured for malting and brewing, but barley of high protein content is more desirable for animal feed.

The total digestible nutrients in barley are given as 79%. Digestible coefficients for constituents of ground barley are 76% for protein, 80% for fat, 92% for carbohydrate and 56% for fibre (Morrison, 1947).

The feeding value of barley is said to be equal to that of maize for ruminants (Hockett, 1991) and 85–90% of that of maize for swine (Cromwell, 1991). For swine, barley can replace all the maize in the feed; indeed, barley is preferred to maize for certain animals, e.g. pigs. The feeding value of barley for pigs is improved by grinding, pelleting, cubing, rolling or micronizing (Hockett, 1991). It is also used extensively in compound feeds.

For poultry, a feed containing barley and maize improved egg production and feed efficiency as compared with either cereal fed alone (Lorenz and Kulp, 1991).

Swine fed barley grew faster and had a more efficient feed/gain ratio if the barley was pelleted than if fed as meal. Feed for pregnant sows and gilts can contain up to 85% of ground barley, up to 65% for lactating sows, 80% for growing pigs and 86% for finishing pigs (Cromwell, 1991).

The barley is normally fed either crushed or as a coarse meal, thereby avoiding wastage that could result from the passage of undigested grains through the alimentary tract. The widespread use